

REMARKS

This is intended as a full and complete response to the Office Action dated July 29, 2003, having a shortened statutory period for response set to expire on October 29, 2003. Claims 1-18, 26-31 and 33 remain pending in the application and are shown above. Please reconsider the claims pending in the application for reasons discussed below.

The Examiner states that the oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is submitted herewith. Withdrawal of the objection is respectfully requested.

35 U.S.C. §103 Rejections

Claims 1-3, 8, 12-14, 16, 26, 27 and 33 are not obvious over *Small* in view of *Svirchevski et al.* under 35 U.S.C. §103(a)

Claims 1-3, 8, 12-14, 16, 26, 27 and 33 stand rejected under 35 USC § 103(a) as being obvious over United States Patent No. 5,981,454 to *Small* and United States Patent No. 6,352,595 to *Svirchevski et al.* The Examiner states that *Small* discloses a method of cleaning a wafer using a polishing pad and applying a cleaning composition that has an amine concentration including at least one endpoint of the claimed range, from the wafer to the polishing pad surface. The Examiner also states that the explicitly disclosed range of the amine is 3-20%; however, Figure 3 appears to contemplate a range of activity below 3% and *Small* further discloses an acid or base such that the composition has a pH of between 3.5 and 7, which anticipates the range of about 5.0 to about 12.0. The Examiner also states *Svirchevski* discloses a method of cleaning a chemical mechanical polishing (CMP) pad by applying chemicals to the surface of the CMP pad and thereafter rinsing the pad. The Examiner asserts that *Small* provides the motivation for making the instant combination.

Applicant respectfully traverses the rejection. *Small et al.* discloses a method of cleaning a wafer with a post clean treatment composition to rinse and remove chemical residues from a wafer having metal or dielectric surfaces after a wet chemistry step,

such as post etch residue cleaning step. (See, column 1, lines 29-37 and 45-52.) The post clean treatment composition of *Small et al.* is for cleaning a wafer by rinsing the wafer in a bath or a beaker (container) containing the post clean treatment solution (PCT), e.g., step 22 in Figure 2. The immersion duration disclosed in *Small* is from 30 min (Example 2) to 24 hours (Example 3). The rinsing step 22 of *Small* may employ the post clean treatment solution of *Small* in place of a carbonated water rinse step 16, an isopropyl alcohol rinse step 18, or an N-methyl pyrrolidone rinse step 20, in a typical process sequence after a cleaning step of an ashing step 12 or a wet chemistry step 14 to clean photoresist or etch residues. (See, column 3, lines 40-51, and Figure 2.) *Small* does not teach, show, or suggest the method of cleaning a polishing pad, as claimed in claims 1, 12, 26, and claims dependent therefrom. *Svirchevski et al.* discloses a method of cleaning a polishing pad using a composition of hydrogen chloride (HCl) and water when the wafer surface is copper, or ammonium hydroxide (NH₄OH) and water, when the wafer surface is oxide. *Svirchevski et al.* does not teach, show, or suggest the composition as claimed in claims 1, 12, 26, and claims dependent therefrom.

With regard to the Examiner's comments on the disclosed amine range of Figure 3 in *Small*, Applicants respectfully point out that the cited Figure 3 of *Small* is not directed to the post clean treatment composition of *Small* as the Examiner stated, but rather a testing of corrosion rate of aluminum (Al) metal, on a wafer surface as a function of amine concentrations (from 0% to 100%) when rinsing the post clean wafer with a water solution containing 0% to about 100% of amine. Thus, Figure 3 is to demonstrate the problem of using just amine as rinsing agent and "clearly shows that very small quantities of amines will be very corrosive to the metal". (See, column 3, lines 53-60, column 4, lines 7-10, and Figure 3.)

In addition, the Examiner has erred in stating that explicitly disclosed range of the amine is 3-20%. Applicants respectfully point out that the cited 3-20% of amine concentration in water is not directed to the post clean treatment composition of *Small* as the Examiner stated, but rather a statement of the background problem that need to be solved by *Small's* post clean treatment solution so as to rapidly neutralize amine and prevent corrosion of metal structure and other features on a wafer. (See, column 3, lines

54-62.) Thus, *Small* does not teach, show, or suggest the method and composition as claimed.

Therefore, Applicants respectfully disagree with the Examiner and point out that *Small et al.* does not teach, show, or suggest a method of cleaning a polishing pad surface comprising applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, as recited in claims 1, 12, 26, and claims dependent therefrom.

In addition, *Small* discloses that the post clean treatment composition can also be used in a chemical mechanical planarization (CMP) process after a final cleaning step (post CMP clean), such as a brush scrub and a rinse, to further rinse and clean a wafer in the absence of a polishing pad, or directly at a polishing step of silicon oxide CMP or metal CMP by applying the post clean treatment composition on a wafer to polish the wafer in the presence of a polishing pad. (See, column 4, lines 35-44, column 5, lines 15-17, column 6, lines 1-7 and lines 38-41.) *Small* further discloses that "copper films present a difficult problem because it is a soft metal and is easily damaged by the slurry particles".

Thus, *Small's* post clean treatment composition is for rinsing the wafer in the absence of a polishing pad or polishing a copper surface of a wafer in the presence of a polishing pad. Applicants respectfully disagree with the Examiner and point out that *Small* provide no motivation to combine the teachings and does not teach, show, suggest, or motivate applying *Small's* post clean treatment composition for cleaning a polishing pad. Therefore, Applicants respectfully point out that *Small* does not teach, show, or suggest subsequent to chemical mechanical polishing (CMP) a wafer surface containing copper (Cu) or a Cu-based alloy, a method of cleaning a polishing pad surface including applying a cleaning composition to the polishing pad surface, as recited in claims 1, 12, 26, and claims dependent therefrom.

Further, with regard to the pH range, the acidic pH range of about 3.5 to 7 of *Small's* post clean treatment composition is provided to neutralize the pH of a wafer until the pH reaches 7 and prevent corrosion of metal structure on a wafer during rinsing.

Small does not teach, show, or suggest a cleaning composition at both acidic and basic pH range of about 5.0 to about 12.0 for a polishing pad surface, as recited in claims 1, 12, 26, and claims dependent therefrom. *Small* teaches a composition for different processes than claimed, *i.e.*, rinsing a wafer or polishing a wafer using *Small*'s post clean treatment composition, rather than cleaning a polishing pad surface that has been used and left with copper residues after CMP. Due to the obvious different materials of a wafer and a polishing pad and the complexity of chemistry involved in various different processes, *e.g.*, post etch wafer cleaning, wafer polishing by CMP, post CMP wafer cleaning, as compared to the claimed post CMP and between CMP pad cleaning, comparing the pH range of one composition suitable for a first material in a first process with the pH range of another composition to be used for a second material in a second process is not appropriate. Therefore, the references, alone or in combination, do not teach, show, or suggest the method and composition, as recited in claim 1, 12, 26, and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claims 12-14 and 16 are not obvious over *Small* in view of *Svirchevski et al.* under 35 U.S.C. §103(a)

Claims 12-14 and 16 stand rejected under 35 USC § 103(a) as being obvious over *Small* as set forth above and United States Patent No. 6,352,595 to *Svirchevski et al.* The Examiner states that the composition is disclosed in *Small* and what is not explicitly disclosed is the cleaning of the pad between polishing a first wafer and second wafer. The Examiner also states that *Small* explicitly provides the motivation for making the instant combination and *Svirchevski et al.* discloses a method of cleaning a chemical mechanical polishing (CMP) pad that has already been used for performing a CMP operation on a wafer surface. The Examiner states that the chemical disclosed in *Small* is disclosed to be useful because it eliminates the need for flammable solvents, lowers transition metal ion concentrations, and has a high neutralization capacity, and the rational [rationale?] for cleaning between a first and second wafer would include minimization of contamination build-up and minimization of subsequent bath contamination.

Applicant respectfully traverses the rejection. *Small* and *Svirchevski et al.* have been discussed above. *Small* does not teach, show, or suggest the claimed composition in the claimed range for the claimed method and nowhere does *Small* provide motivation to use *Small's* composition for cleaning a polishing pad between polishing a first and a second wafer. The advantage of *Small's* post clean treatment composition as a rinsing composition for a wafer as stated by the Examiner and disclosed in *Small* does not provide motivation or rationale for cleaning a polishing pad between polishing a first and a second wafers. Withdrawal of the rejection is respectfully requested.

Claims 4-7, 9-11, and 28-31 are not obvious over *Small* in view of *Kennedy et al.* under 35 U.S.C. §103(a)

Claims 4-7, 9-11, and 28-31 stand rejected under 35 USC § 103(a) as being obvious over *Small* and United States Patent No. 6,280,299 to *Kennedy et al.* The Examiner states that *Small* apparently fails to explicitly disclose applying the solution to a rotating polishing pad at a flow rate of about 10 to 600 ml/min, and *Kennedy et al.* discloses using a flowrate between 230 and 6000 ml/min. The Examiner also states that an artisan would have been motivated by *Kennedy et al.* to optimize pad cleaning flowrates and pressures for performing the same task, in the same way, and for the same reason, and the duration of the flow would be a matter of routine optimization. The Examiner also point out that with specific respect to claims 4 and 28 disclosing a pH range of “about 8 to about 11”, the taught value of “about 7” seemingly would read on “about 8”, while these values may not be contextually taught with identical values. Applicant respectfully traverses the rejection.

Applicant respectfully traverses the rejection. *Small* is discussed above. *Small* does not teach, show, or suggest the method and composition as claimed. In addition to the above discussion of pH range of *Small's* post clean treatment composition, Applicants respectfully point out that a pH range of about 8 to about 11 is basic and pH about 7 is neutral and does not suggest basic pH range.

Kennedy et al. discloses methods and apparatus of cleaning a polishing pad surface or a substrate surface. *Kennedy et al.* does not teach, show, or suggest the composition as claimed in claims 1, 12, 26, and claims dependent therefrom. As

discussed above, there is no motivation existed in either references to combine *Small's* wafer cleaning composition with *Kennedy et al.* polishing pad cleaning method.

Further, *Small's* composition works by rinsing a wafer in a bath such as immersing the wafer for a duration of 30 min (Example 2) to 24 hours (Example 3) rather than for cleaning a polishing pad surface for a short time period after CMP. Thus, *Small* does not teach, show, or suggest applying a solution to a polishing pad for about 3 seconds to about 20 seconds after conducting CMP as recited in claims 7, 18, and 30, and can not be served as basis for the *Small* composition to be combined with *Kennedy et al.*

Therefore, the references, alone or in combination, do not teach, show, or suggest the method as recited in claims 4-7, 9-11, and 28-31. Withdrawal of the rejection is respectfully requested.

Claims 15, 17, and 18 are not obvious over *Small* in view of *Svirchevski et al.* and *Kennedy et al.* under 35 U.S.C. §103(a)

Claims 15, 17, and 18 stand rejected under 35 U.S.C. 103(a) as being obvious over *Small*, *Svirchevski et al.* and *Kennedy et al.* as set forth above. The Examiner states that *Small* and *Svirchevski* apparently fail to explicitly disclose applying the solution to a rotating polishing pad at a flow rate of about 10 to 600 ml/min, and *Kennedy et al.* discloses using a flowrate of between 230 and 6000 ml/min. The Examiner also point out that with specific respect to claim 15, if it is asserted that there are real material differences observed between a pH of 7 and a pH of 8, seemingly such evidence would overcome the obvious rejection. But note that pH values of greater than 10 (and therefore including 11) are disclosed in *Small*. Applicant respectfully traverses the rejection.

Applicant respectfully traverses the rejection. *Small*, *Svirchevski et al.*, and *Kennedy et al.* have been discussed above. *Small* does not teach, show, or suggest the method and composition as claimed and *Svirchevski et al.* and *Kennedy et al.* do not teach, show, or suggest the composition as claimed. As discussed above, there is no motivation in the references to combine *Small's* wafer cleaning composition with

Svirchevski et al. and *Kennedy et al.*'s polishing pad cleaning method despite the disclosure of flow rates in the method of *Svirchevski et al.* and *Kennedy et al.*

Further, *Small*'s composition works by rinsing a wafer in a bath such as immersing the wafer for a duration of 30 min (Example 2) to 24 hours (Example 3) rather than for cleaning a polishing pad surface for a short time period after CMP. Thus, *Small* does not teach, show, or suggest applying *Small*'s post clean treatment solution to a polishing pad for about 3 seconds to about 20 seconds after conducting CMP as recited in claims 7, 18, and 30, and can not be served as basis for the *Small* composition to be combined with *Svirchevski et al.* and *Kennedy et al.*

Therefore, the references, alone or in combination, do not teach, show, or suggest the method as recited in claims 4-7, 9-11, and 28-31. Withdrawal of the rejection is respectfully requested.

In conclusion, the references cited by the Examiner, alone or in combination, do not teach, show, or suggest the invention as claimed.

Having addressed all issues set out in the office action, Applicant respectfully submits that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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